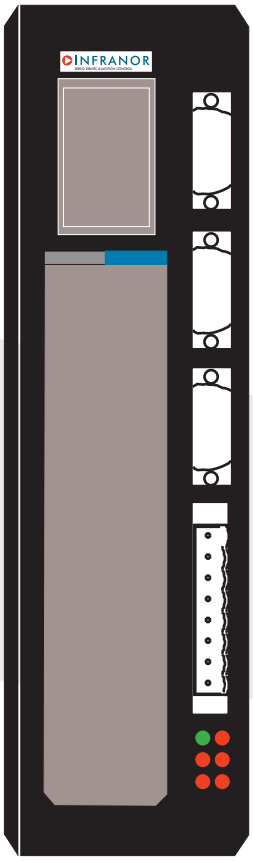
INFRANOR
SERVO DRIVES & MOTION CONTROL

CD1-p
Installation manual

gb



PROFIBUS POSITIONER

INFRANOR®

WARNING

This is a general manual describing a series of servo amplifiers having output capability suitable for driving AC brushless sinusoidal servo motors. This manual may be used in conjunction with appropriate and referenced drawings pertaining to the various specific models.

Instructions for storage, use after storage, commissioning as well as all technical details require the MANDATORY reading of the manual before getting the amplifiers operational.

Maintenance procedures should be attempted only by highly skilled technicians having good knowledge of electronics and servo systems with variable speed (EN 60204-1 standard) and using proper test equipment.

The conformity with the standards and the "CE" approval is only valid if the items are installed according to the recommendations of the amplifier manuals. Connections are the user's responsibility if recommendations and drawings requirements are not met.

Any contact with electrical parts, even after power down, may involve physical damage.
Wait for at least 5 minutes after power down before handling the amplifiers (a residual voltage of several hundreds of volts may remain during a few minutes).

ESD INFORMATION (ElectroStatic Discharge)
INFRANOR amplifiers are conceived to be best protected against electrostatic discharges. However, some components are particularly sensitive and may be damaged if the amplifiers are not properly stored and handled.

STORAGE

- The amplifiers must be stored in their original package.
- When taken out of their package, they must be stored positioned on one of their flat metal surfaces and on a dissipating or electrostatically neutral support.
- Avoid any contact between the amplifier connectors and material with electrostatic potential (plastic film, polyester, carpet…).

HANDLING

- If no protection equipment is available (dissipating shoes or bracelets), the amplifiers must be handled via their metal housing.
- Never get in contact with the connectors

ELIMINATION
In order to comply with the 2002/96/EC directive of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE), all INFRANOR devices have got a sticker symbolizing a crossed-out wheel dustbin as shown in Appendix IV of the 2002/96/EC Directive.
This symbol indicates that INFRANOR devices must be eliminated by selective disposal and not with standard waste.

INFRANOR does not assume any responsibility for any physical or material damage due to improper handling or wrong descriptions of the ordered items.
Any intervention on the items, which is not specified in the manual, will immediately cancel the warranty.

Infranor reserves the right to change any information contained in this manual without notice.

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Contents

PAGE

CONTENTS **5**

CHAPTER 1 – GENERAL DESCRIPTION **7**

1- INTRODUCTION 7
2 - DESCRIPTION / COMPLIANCE WITH THE STANDARDS 7
2.1 - GENERAL DESCRIPTION *7*
2.2 - REFERENCE TO THE STANDARDS: "CE" CERTIFICATION *7*
2.3 - REFERENCE TO THE STANDARDS: "UL" LISTING *7*
3 - OTHER DOCUMENTS REQUIRED FOR THE COMMISSIONING 8

CHAPTER 2 – SPECIFICATIONS **9**

1 - MAIN TECHNICAL DATA 9
1.1 - CD1-p-230-/I POSITIONER *9*
1.2 - CD1-p-400/I POSITIONER *9*
1.3 - COMMON SPECIFICATIONS TO BOTH POSITIONER VERSIONS CD1-p-230/I *10*
AND CD1-p-400/I *10*
2 - DIMENSIONS 12
2.1 - CD1-p-230/I POSITIONER *12*
2.2 - CD1-p-400/1.8 TO 7.2 POSITIONER *12*
2.3 - CD1-p-400/14 POSITIONER *12*
2.4 - CD1-p-400/30 and 45 POSITIONER *12*
2.5 - BRAKING RESISTOR dp 100/100, dp 200/100, dp 50/200 and dp 33/280 ..... *13*
3 - FASTENING 14
3.1 - CD1-p-230/I POSITIONER *14*
3.2 - CD1-p-400/1.8 TO 7.2 POSITIONER *14*
3.3 - CD1-p-400/14 POSITIONER *14*
3.4 - CD1-p-400/30 and 400/45 POSITIONER *14*
4 - MULTIAXES CABINET MOUNTING 15
4.1 - CD1-p-230/I POSITIONER *15*
4.2 - CD1-p-400/1.8 TO 7.2 POSITIONER *15*
4.3 - CD1-p-400/14 POSITIONER *15*
4.4 - CD1-p-400/30 AND 400/45 POSITIONER *15*

CHAPTER 3 - INPUTS - OUTPUTS **16**

1 - CONNECTORS LOCATION 16
2 - LEDs 17
2.1 - AMPLIFIER FAULT LEDs *17*
3 - X1: RESOLVER CONNECTOR 17
4 - X4: COMMAND CONNECTOR 18
4.1 - SPECIFICATIONS OF THE LOGIC INPUTS: FC+, FC-, INDEX, ENABLE, CI *18*
4.2 - SPECIFICATION OF THE "AOK" LOGIC RELAY OUTPUT *18*
5 - X6: PROFIBUS 18
6 - X5: RS-232 CONNECTOR 19
7 - X8: AUXILIARY SUPPLY AND BRAKE CONNECTOR 19
8 - X9: POWER CONNECTOR: MAINS, MOTOR, BRAKING RESISTOR (CD1-P-230 V AND 400 V) 19

CHAPTER 4 - CONNECTIONS **21**

1 - CONNECTION DIAGRAMS 21
1.1 - CD1-p-230/I POSITIONER *21*
1.2 - CD1-p-400/I POSITIONER *22*
1.3 - SERIAL LINK CONNECTION *22*
1.4 - CONNECTION OF A BACKUP BATTERY FOR THE 24 VDC AUXILIARY SUPPLY *23*
1.5 - CONNECTION EXAMPLE FOR A MULTIAXIS APPLICATION *23*

2 - WIRING RECOMMENDATIONS 24
2.1 - EARTH WIRING AND EARTHING 24
2.2 - CONNECTORS SHIELD CONNECTION 25
2.3 - CONNECTION VUE OF CD1-p-400/30 and 400/45 26
2.4 - MOTOR AND RESOLVER CABLES 26
2.5 - SERIAL LINK CABLES 27
2.6 - CONNECTION CABLES OF THE BRAKING RESISTOR 27
3 - REQUIREMENTS OF COMPLIANCE WITH THE UL STANDARDS 27
3.1 - CONNECTION BY MEANS OF FASTON SOCKET 27
3.2 - 24 V SUPPLY 27
3.3 - POWER SUPPLY AND UL FUSE RATING 27
3.4 - CD1-p-230/I DRIVE: CONNECTION DIAGRAM WITH PROTECTIONS BY "UL" FUSES ... 28
3.5 - CD1-p-400/I DRIVE: CONNECTION DIAGRAM WITH PROTECTIONS BY "UL" FUSES ... 29
3.6 - CONNECTION EXAMPLE FOR A UL COMPLIANT MULTIAXIS APPLICATION 30
4 - FIRST POWERING OF THE CD1-P POSITIONER 30
4.1 - VERY IMPORTANT 30
4.2 - SWITCH ON THE 24 VDC SUPPLY 30
4.3 - SWITCH ON THE 230 VAC OR 400 VAC SUPPLY (according to the positioner type). 30
4.4 - FURTHER COMMISSIONING PROCEDURE 30

CHAPTER 5 – APPENDIX 31

1 - HARDWARE ADJUSTMENTS 31
2 - BR JUMPER POSITION FOR CD1-P-400/14 A 32
3 - BR JUMPER POSITION FOR CD1-P-400/30 AND 400/45 A 32
4 - BR JUMPER POSITION FOR CD1-400/1.8 TO 7.2 A 33
5 - ADJUSTMENT TO VARIOUS RESOLVER TYPES 33
6 - USE OF THE "AOK" OUTPUT 34
7 - ENERGY RECUPERATION VIA A BRAKING RESISTOR 34
8 - ORDER CODE 35

Chapter 1 – General description

1- INTRODUCTION

Series CD1-p Profibus positioners are PWM servo amplifiers for the control of AC sinusoidal motors (brushless) with transmitter resolver.

The CD1-p system is available as a stand-alone single-axis block that includes all supplies and mains filter. It is available in both mains operated versions 230 VAC and 400/480 VAC.

The CD1-p positioner operates with a PROFIBUS DP interface. It generates itself the positioning trajectory that allows the programming of 128 positioning sequences.

2 – DESCRIPTION / COMPLIANCE WITH THE STANDARDS

2.1 - GENERAL DESCRIPTION

Series CD1-p positioners have their own DC/DC converter to provide appropriate logic voltage to the modules. An auxiliary 24VDC +/- 15 % supply is generally available on all machines and supplies a DC/DC converter with all logic supplies required by the positioner. The auxiliary supply allows to keep the logic board on, after the power supply has been switched off, in order to keep all parameters in the memory and to avoid initializing the machine all over again. A 24 VDC battery supply with specific wiring allows to keep the position even after switching off the auxiliary 24 VDC supply. This wiring can be used for "absolute" operation with the CD1-p positioner (see chapter 4: Connections).
The power supply is depending on the positioner type:

- CD1-p-230/I: 230 VAC single-phase mains operation power supply or three-phase via a transformer or an autotransformer (or direct three-phase mains operation if there are three-phase mains available in 200 to 230 VAC).
- CD1-p-400/I: 400 to 480 VAC three-phase mains operated power supply.

A soft start system of the power supply allows to limit the inrush current at power on.

The very small dimensions of the CD1-p positioner allow an optimum integration in 300 mm deep cabinets (connectors included).

2.2 - REFERENCE TO THE STANDARDS: "CE" CERTIFICATION

Series CD1-p positioners have been approved with regard to their conformity with the Electromagnetic Compatibility standards concerning the power servos referenced in the EN 61800-3 standard "Electrical variable speed power servo systems":

- EN 55011, group 1, class A, regarding radiated radioelectric disturbances,
- EN 61000.4-2-3-4-5 regarding immunity.

Standard to be applied to the electrical equipment of industrial machines: EN 60204-1.

These items have been "CE" marked since year 2000.

2.3 - REFERENCE TO THE STANDARDS: "UL" LISTING

CD1-p series have been "$_{C}UL_{US}$" listed according to UL508C, and UL840 regarding the insulator.

This product was evaluated to:

- the Third Edition of UL508C, the UL Standard for Power Conversion Equipment, dated May 2002 for the UL Listing (USL),
- the CSA Standard for Industrial Control Equipment, C22.2 N° 14-95, dated August 1995 for the Canadian UL Listing (CNL).

Providing that the manual is specifying that the end user has to provide an isolated power supply, for 24 VDC auxiliary input protected by a 4 A UL Listed fuse, the power board is considered within a limited voltage/current circuit per section 31.4 of UL508C. Therefore, spacings on the power board are not required to be evaluated per section 31.2 of UL508C and were evaluated according to UL 840.

Per UL 840 (Second Edition, dated May 20, 1993) requirements, spacings are limited to 2.5 mm assuming pollution degree 2 environment.

Ground connection is fixed in the frame of the device by a rivet, Avibulb masse, BN10-5168. The connector complies with standard dimensions given in table 6.2 of UL 310, the standard for Electrical Quick connect terminals.

3 - OTHER DOCUMENTS REQUIRED FOR THE COMMISSIONING

- Profibus positioner – " SMT-BD1/p CD1-p User Guide".

Chapter 2 – Specifications

1 - MAIN TECHNICAL DATA

1.1 - CD1-p-230-/I POSITIONER

Mains operated power supply voltage	230 VAC + 10 %/- 15 % 1~ or 3~, 50 - 60 Hz
Isolated auxiliary galvanic and motor brake supply voltage	24 VDC +/- 15 % - 320 mA without brake
Motor phase-phase output voltage	200 V_{rms}
Integrated braking system	External 100 Ohm/100 W braking resistor (dp 100/100) Min. resistance: 50 Ohm (dp 50/200)
Minimum inductance between phases	1 mH

Positioner output current ratings

AMPLIFIER TYPE	U rated (Vrms)	Imax (Arms) +/-5 % 1 s	Max. rated current of the amplifier (A rms)	Power losses (W)	UL listed
CD1-p-230/2,25	230	2,25	1,1	25	yes
CD1-p-230/4,5	230	4,5	2,25	30	yes
CD1-p-230/7,5	230	7,5	3,75	44	yes
CD1-p-230/10,5	230	10,5	5,25	55	yes
CD1-p-230/16,5	230	16,5	8,25	66	yes

Maximum room temperature = 40° C.

1.2 - CD1-p-400/I POSITIONER

Mains operating power supply voltage	400 to 480 VAC + 10 %/- 15 % 3~, TN or TT system with earthed neutral point 50 to 60 Hz (phase-earth voltage must be balanced)
Isolated auxiliary galvanic and motor brake supply voltage	24 VDC +/- 15 % - 320 mA without brake
Motor phase-phase output voltage	380 to 460 Vrms depending on the mains
Integrated braking system	CD1-p-400/1.8 to 7.2 A: External 200 Ohms/100 W resistor (dp 200/100) CD1-p-400/14: External 50 Ohms/200 W resistor (dp 50/200) CD1-p-400/30 and 45 A : External resistor 33Ω/280 W (dp 33/280)
Minimum inductance between phases	2 mH

AMPLIFIER OUTPUT CURRENT RATINGS
Output voltage range for 400-480 VAC (rms) three-phase mains
Output current range: 1.8 A, 2.7 A, 5.1 A, 7.2 A, 14 A, 30 A, 45 A (rms)

AMPLIFIER TYPE	Max. output current for 1 s. (480 VAC)	Rated output current (480 VAC)	Power losses (W)	Rated input current (480 VAC 60 Hz)	Housing dimensions	Max. branch circuit protection Listed RK5 (Bussman / Littelfuse) fuses	Short-circuit withstand rating	UL listed
CD1-p-400/1.8	1.8	0.9	35	0.9	230x230x65	2 A	5 kA	yes
CD1-p-400/2.7	2.7	1.35	43	1.35	230x230x65	2 A	5 kA	yes
CD1-p-400/5.1	5.1	2.55	71	2.55	230x230x65	4 A	5 kA	yes
CD1-p-400/7.2	7.2	3.6	93	3.6	230x230x65	4 A	5 kA	yes
CD1-p-400/14	14.0	7	200	7	230x258x83	8 A	5 kA	yes
CD1-p-400/30	30.0	15	400	15	230x288x110	20 A	5 kA	yes
CD1-p-400/45	45.0	20	560	20	230x288x110	20 A	5 kA	yes

Environment: Appendix type 1, compliant with a room temperature of 40° C.

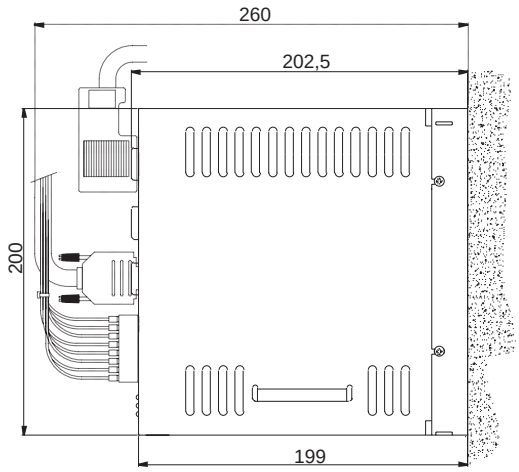
1.3 - COMMON SPECIFICATIONS TO BOTH POSITIONER VERSIONS CD1-p-230/I AND CD1-p-400/I

Regulation loops: current, speed and position	Digital
Mains filter on power supply	Integrated in the positioner
Common mode filter on auxiliary supply	Integrated in the positioner
Common mode filter on motor brake supply	Integrated in the positioner
Speed and position monitor sensor	Transmitter resolver
Power stage protections	See table of the main protections in the SMT-BD1/p CD1-p User Guide
Motor brake control	Max. 1.5 A with 24 VDC
PWM switching frequency	10 kHz
Minimum inductance between phases	1 mH for 230 V / 2 mH for 400 V
Digital current regulator (PI)	Adjusted to the motor
Current loop bandwidth	Cut-off frequency for 45° phase shift : 1000 Hz
Internal current limitation	Imax: 20 % to 100 % and Irated: 20 % to 50 % Imax duration = 1 second
Digital speed and position regulators	Sampling period = 0,5 ms Anti-wind-up system of the integrator Adjustable digital gains
Speed loop bandwidth	Selectable cut-off frequency for 45° phase shift: 50 Hz, 75 Hz or 100 Hz
Max. motor speed	Adjustable from 100 rpm to 10 000 rpm
Logic inputs	- Enable / Disable: ENABLE - Limit switch +: FC+ - Limit switch -: FC- - Homing input: INDEX - Command input: CI (reserved)

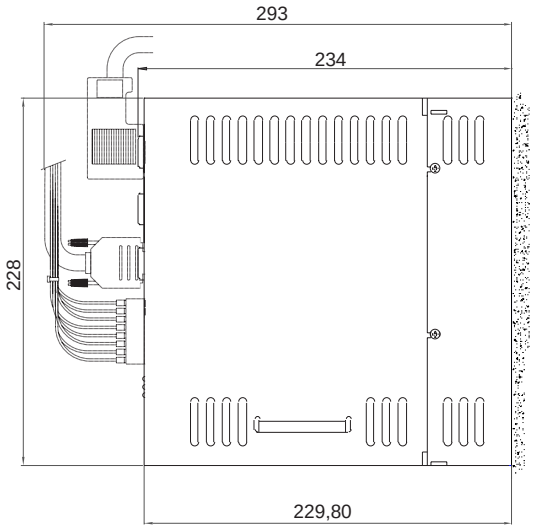
Relay outputs	Relay contact: Umax = 60 V Imax = 200 mA, Pmax = 10 W "Amp ready": Closed if amplifier OK, open if fault
Open collector output protected against load short-circuit	Motor brake coil with 24 VDC/1.5 A
PROFIBUS link	PPO-1 or PPO-2 or PPO-3 or PPO-4.
Fault display	LEDs on front panel and diagnostic by serial link RS232 + diagnostic by PROFIBUS.
Motor and application parameter setting	Serial link RS232 or Profibus DP link
Automatic functions	Amplifier adjustment to the motor (AUTO-PHASING) Automatic regulator tuning (AUTO-TUNING)
Compliance with the standards: **CE** certification. 360° shield connection, equipotentiality according to the wiring rules.	EMC standards: - immunity: EN 61000.4-2-3-4-5 - conducted and radiated disturbances: EN 55011, Group 1, class A Electrical standards for industrial machines: - EN 60204-1 : insulator 1500 Vac / 1 mn leakage current > 30 mA (EMI filters).
Conformity with the standards: **UL** listing "360°" shield; equipotentiality according to the wiring rules.	CD1-p series have been "$_{C}UL_{US}$" listed according to UL508C, and UL840 regarding the insulator. This product was evaluated to: - the Third Edition of UL508C, the UL Standard for Power Conversion Equipment, dated May 2002 for the UL Listing (USL), - the CSA Standard for Industrial Control Equipment, C22.2 N° 14-95, dated August 1995 for the Canadian UL Listing (CNL).
Temperature - storage -20° C à +70° C - operation +5° C à +40° C	From 40° C, the rated currents must be reduced of 3 % per additional Celsius degree Max. temperature: 50° C
Altitude	1000 m
Moisture	< 50% to 40° C and < 90% to 20° C: EN 60204-1 standard **Condensation prohibited** (storage and operation)
Cooling	Forced air (fan integrated in the CD1-p positioner) Check for free ventilation and no upper or lower obstruction of the air admissions
Mounting position	Vertical
Environment	Open chassis to be mounted in a housing protecting the drive from conducting dust and condensation (pollution degree 2 environment)
Mounting location	Closed cabinet without any conducting and/or corroding agents and according to the environment conditions requirements. Condensation prohibited
Weight	CD1-p-230/I: approx. 1 kg CD1-p-400/1.8 to 7.2: approx. 1.5 kg CD1-p-400/14: approx. 3 kg CD1-p-400/30 and 45: about 4.8 kg

2 – DIMENSIONS

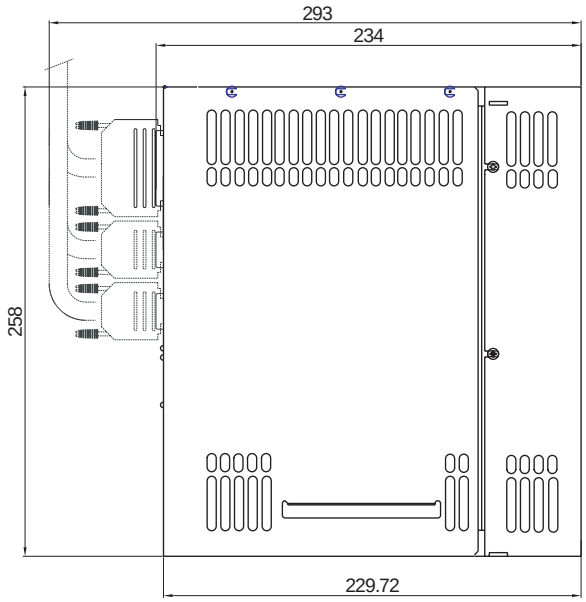
2.1 - CD1-p-230/I POSITIONER



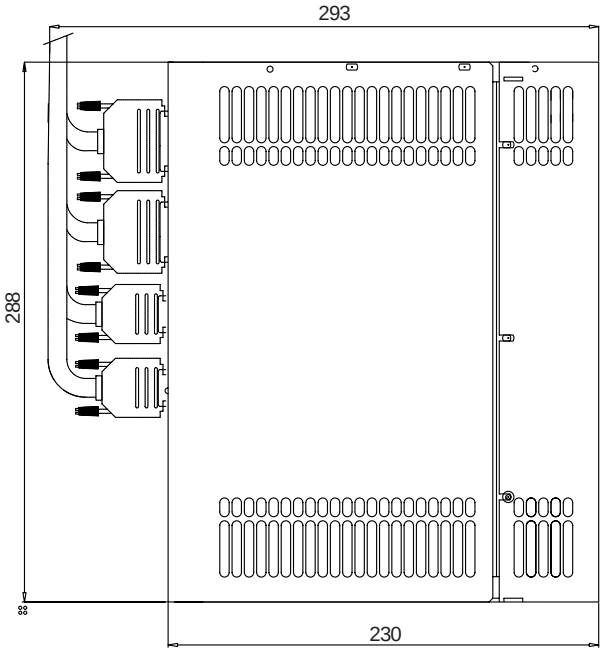
2.2 – CD1-p-400/1.8 TO 7.2 POSITIONER



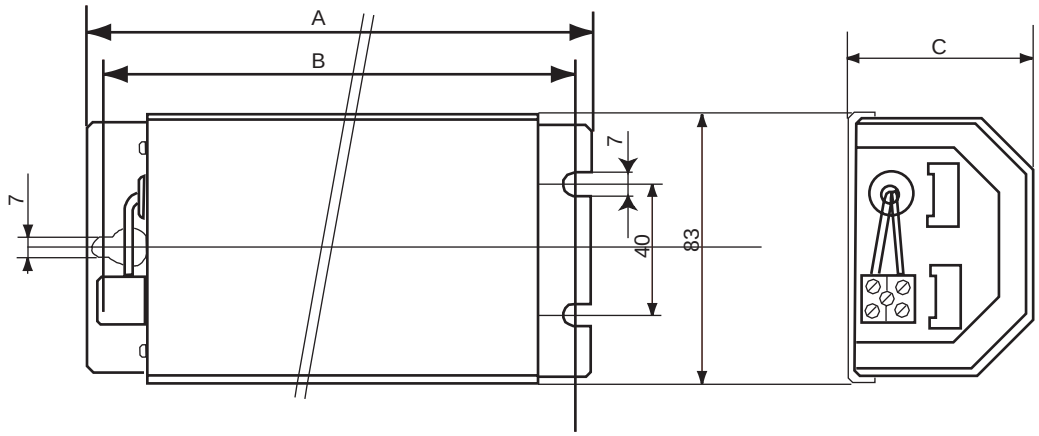
2.3 – CD1-p-400/14 POSITIONER



2.4 – CD1-p-400/30 and 45 POSITIONER



2.5 - BRAKING RESISTOR dp 100/100, dp 200/100, dp 50/200 and dp 33/280

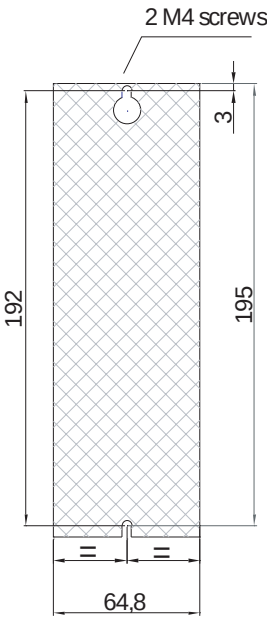


DIMENSIONS	dp 50/200, dp 100/100 and dp 200/100	dp 33/280
Size A	157 mm	290 mm
Size B	145 mm	278 mm
Size C	52 mm	57 mm

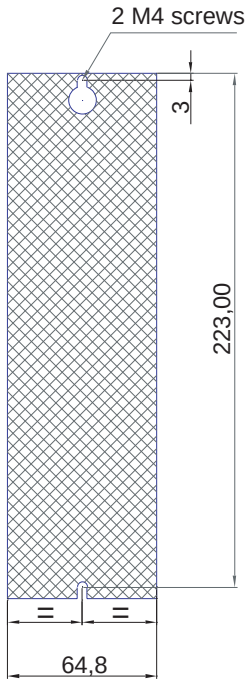
3 - FASTENING

VERTICAL MOUNTING IS MANDATORY

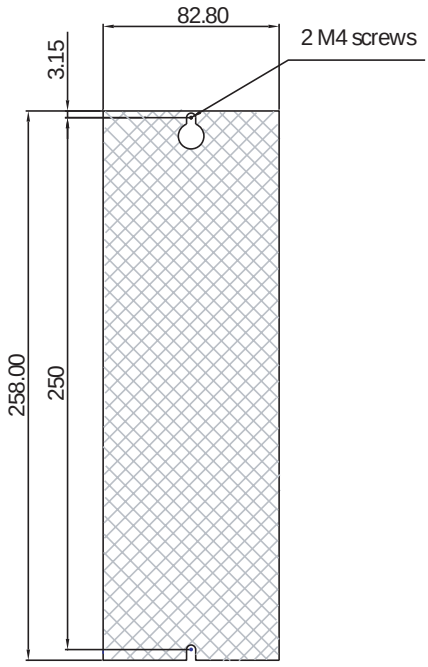
3.1 - CD1-p-230/I POSITIONER



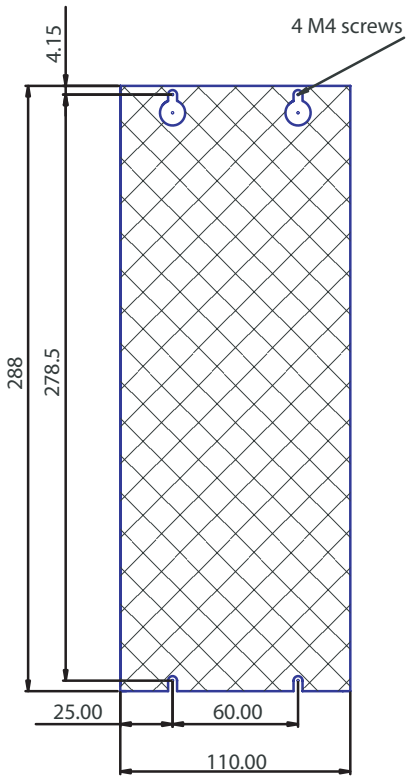
3.2 – CD1-p-400/1.8 TO 7.2 POSITIONER



3.3 – CD1-p-400/14 POSITIONER

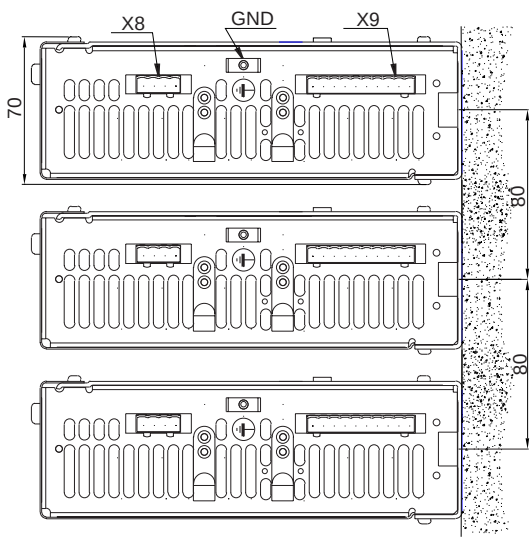


3.4 – CD1-p-400/30 and 400/45 POSITIONER

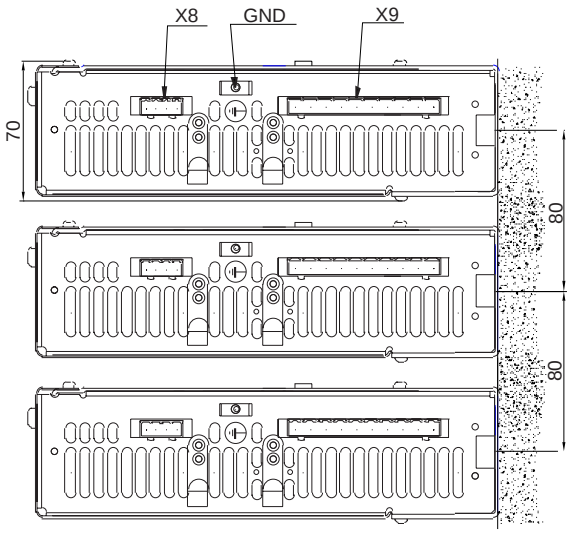


4 – MULTIAXES CABINET MOUNTING

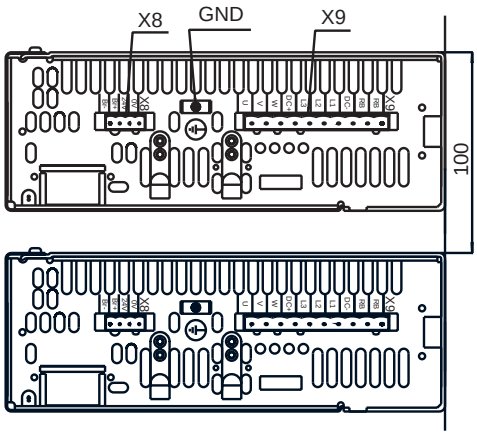
4.1 – CD1-p-230/I POSITIONER



4.2 - CD1-p-400/1.8 TO 7.2 POSITIONER



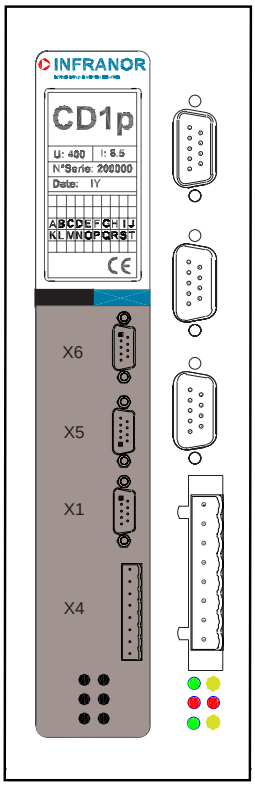
4.3 – CD1-p-400/14 POSITIONER



4.4 – CD1-p-400/30 AND 400/45 POSITIONER

Chapter 3 - Inputs - Outputs

1 - CONNECTORS LOCATION



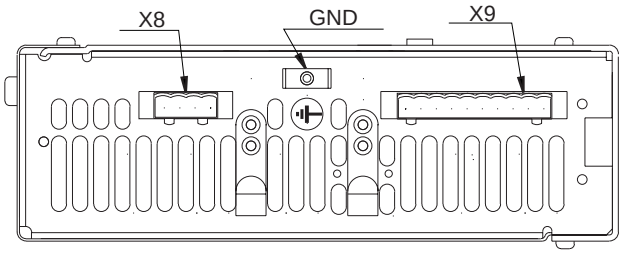
X6 PROFIBUS

X5 Serial link RS-232

X1 RESOLVER sensor

X4 COMMAND connector
AOK
/AOK
ENABLE
FC+
FC-
INDEX
GND
CI

LEDs ON (green) ERROR (red) BUS (green) — SYS (yellow) AP (red) BUSY (yellow)

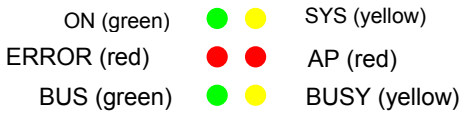


X8 24 Vdc connector and brake
X9 Power connector

2 - LEDs

2.1 – AMPLIFIER FAULT LEDs

Location: below the X4 command connector



ON : power supply
SYS: system fault
ERROR : **Faults grouped on "ERROR" Led: These faults are coded and can be displayed by means of the PC-BD1m software (from version 2.0 and greater) via the serial RS232 link or the Profibus. The "ERROR" Led groups the following faults:**

SA:	Power supply overvoltage
CL:	Out of 24 VDC supply range (between 18 and 29 V)
FT:	Phase/earth short-circuit
FD/R:	Braking system short-circuited or overheated
FV:	Fan
FB:	Short-circuit of the motor holding brake
FO:	Short-circuit, temperature, power stage supply, PWM error
I^2t:	I^2t protection error
RDC:	Digital resolver converter tracking error
POS:	Position following error
E2P:	EEPROM error
BUS:	PROFIBUS communication error (or Positioner initialization/configuration error)
BUSY:	Procedure execution error
TMOT:	Motor temperature
RES:	Resolver cable interruption

BUS: PROFIBUS communication OK.
BUSY: Procedure in progress.
AP: No power supply. The AOK output does not take into account the display of AP.

All faults (except for the "Undervolt." fault) involve:
- the positioner disabling
- the motor brake control.
- the opening of the AOK relay contact. This relay must be wired as described in section 5.3 for switching off the power supply in order to keep a zero type standstill.

The AP fault involves:
- the positioner disabling
- the motor brake control.

3 - X1: RESOLVER CONNECTOR

Sub D 9 pins female (male connector not supplied)

PIN	FUNCTION	NOTE
1	TC (pin H sensor connector)	If thermal switch connected to X1
6	Shield connection	If no "360°" connection on the connector
2	TC (pin I sensor connector)	If thermal switch connected to X1
7	S1 (pin C sensor connector)	MAVILOR motor
3	S3 (pin D sensor connector)	MAVILOR motor
8	S4 (pin B sensor connector)	MAVILOR motor
4	S2 (pin A sensor connector)	MAVILOR motor
9	R2 (pin F sensor connector)	MAVILOR motor
5	R1 (pin E sensor connector)	MAVILOR motor

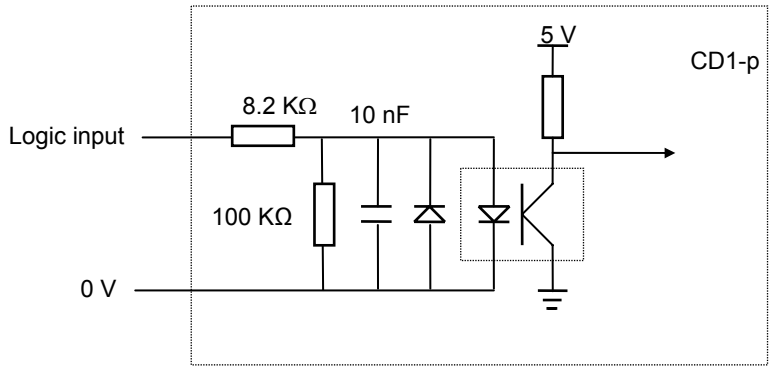
For other resolver connections, see chapter 5 (Appendix), section 4.

4 - X4: COMMAND CONNECTOR

8 pins male connector (with 5.08mm pitch) - (Female connector supplied)
Fastening torque of the connector screws: 0,5 Nm.

PIN	SIGNAL	I/O	REMARK
1, 2	AOK and AOK/	O	Relay contact: closed when amplifier OK Pmax = 10 W with Umax = 50 V or Imax = 100 mA
3	ENABLE	I	Positive optocoupled logic
4	Limit switch +	I	Positive optocoupled logic
5	Limit switch -	I	Positive optocoupled logic
6	INDEX	I	Positive optocoupled logic
7	GND: 0 V of logic inputs	I	Potential reference of the optocoupled (galvanic isolated) logic inputs. This potential reference may be different from the auxiliary supply
8	CI (reserved)	I	Positive optocoupled logic

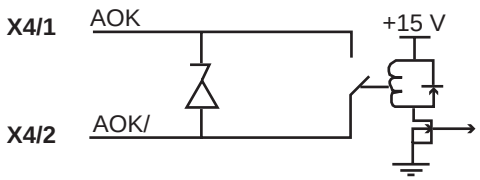
4.1 - SPECIFICATIONS OF THE LOGIC INPUTS: FC+, FC-, INDEX, ENABLE, CI



The input voltage corresponding to level 1 is between 5 V and 24 V

These inputs are optocoupled and work in positive logic.

4.2 - SPECIFICATION OF THE "AOK" LOGIC RELAY OUTPUT



Relay contact: closed if amplifier ready, open if fault.
Pmax = 10 W with Umax = 50 V and Imax = 100 mA.

5 - X6: PROFIBUS

Sub-D 9 pins female (Profibus male connector not supplied)

PIN	SIGNAL	DESCRIPTION
1	Shield	Shield
2		
3	RxD/TxD-P	Data Reception/Transmission (Plus)
4	CNTR-P	Control signal
5	DGND	0 V
6	VP	Supply for termination resistor
7		
8	RxD/TxD-N	Data Reception/Transmission (Minus)
9		

6 - X5: RS-232 CONNECTOR

Sub-D 9 pins male (female connector not supplied)

PIN	FUNCTION	REMARK
5	0 Volt	GND (360° shield connection if no 360° connection on the connector)
3	TXD	Transmit data RS-232
2	RXD	Receive data RS-232

7 - X8: AUXILIARY SUPPLY AND BRAKE CONNECTOR

4 pins male connector (with 5.08 mm pitch). Female connector supplied.
Fastening torque of the connector screws: 0.5 Nm

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION	
1	GND	I	Potential reference of the 24VDC supply	GND = earthed potential reference	
2	+24 VDC	I	24 VDC auxiliary supply mains isolated	24 VDC +/-15% - 0.4 A without brake Regulation with load: 3%	UL: Protection by UL 4 A fuse.
3	Brake + 24 V	O	Motor brake supply with 24 VDC	Powerless brake: 24 VDC / 1.5 A	
4	Brake -	O	Direct motor brake control Imax = 1.5A	Open collector output protected against load short-circuits	

If there is no brake on the motor, the electronic brake control circuit is detecting the missing load and displays the "brake" error. In this case, remove the BR jumper located on the hardware adjustments diagram (see chapter 5, section 1).

8 - X9: POWER CONNECTOR: MAINS, MOTOR, BRAKING RESISTOR (CD1-p-230 V AND 400 V)

CD1-p-230/I: 10 pins male connector (with 5.08 mm pitch). Female connector supplied.
CD1-p-400/I: 10 pins male connector (with 7.62mm pitch). Female connector supplied.

Fastening torque of the connector screws: 0.5 Nm

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	RB	O	Power feedback during the motor deceleration with high inertia and speed	**CD1-p-230/I: 100 Ohms/100W (dp 100/100)** **CD1-p-400/1.8 to 7.2: 200 Ohms/100W (dp 200/100)** **CD1-p-400/14: 50 Ohms/200 W (dp 50/200)** **CD1-p-400/30 and 45: 33 Ohms/280 W (dp 33/280)** (Braking resistors must be separately ordered)
2	RB	O		
3	DC-	I/O	Parallel connection of the DC bus	Only on UL listed items.
4	L1	I	Mains input **Mains filter integrated in the positioner**	**CD1-p-230/I 230 VAC 1~ or 3~** **CD1-p-400/I 400 to 480 VAC 3~**
5	L2	I		
6	L3	I		
7	DC+	I/O	Parallel connection of the DC bus	Only on UL listed items.
8	W	O	Motor phase W	Motor cable with earthed connection by means of Faston socket and 360° shield connection on earthed collar
9	V	O	Motor phase V	
10	U	O	Motor phase U	

IMPORTANT: The motor and brake cable must be shielded and connected over 360° on collars mounted for this purpose on the housing. The earth wire of the motor cable MUST be connected to the Faston socket marked with the GND sign.
The earth reference must also be connected on the second Faston socket.

- The installer of the drives has to use a UL Listed Quick connect for ground connection (0.250 inches or 6.35 mm wide nominal).
- Field wiring terminals have to use copper conductors only.

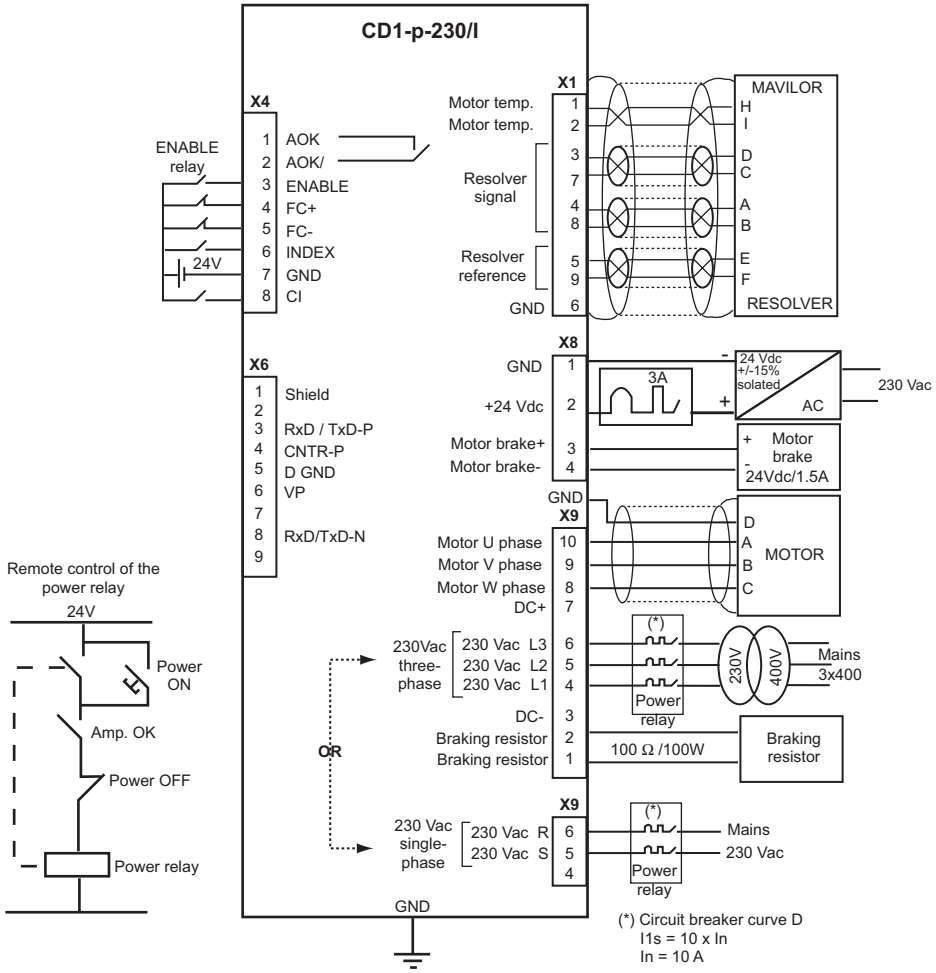
Torque value for field wiring terminals: value to be according to the Recognized terminal block used.

Chapter 4 – Connections

1 - CONNECTION DIAGRAMS

1.1 – CD1-p-230/I POSITIONER

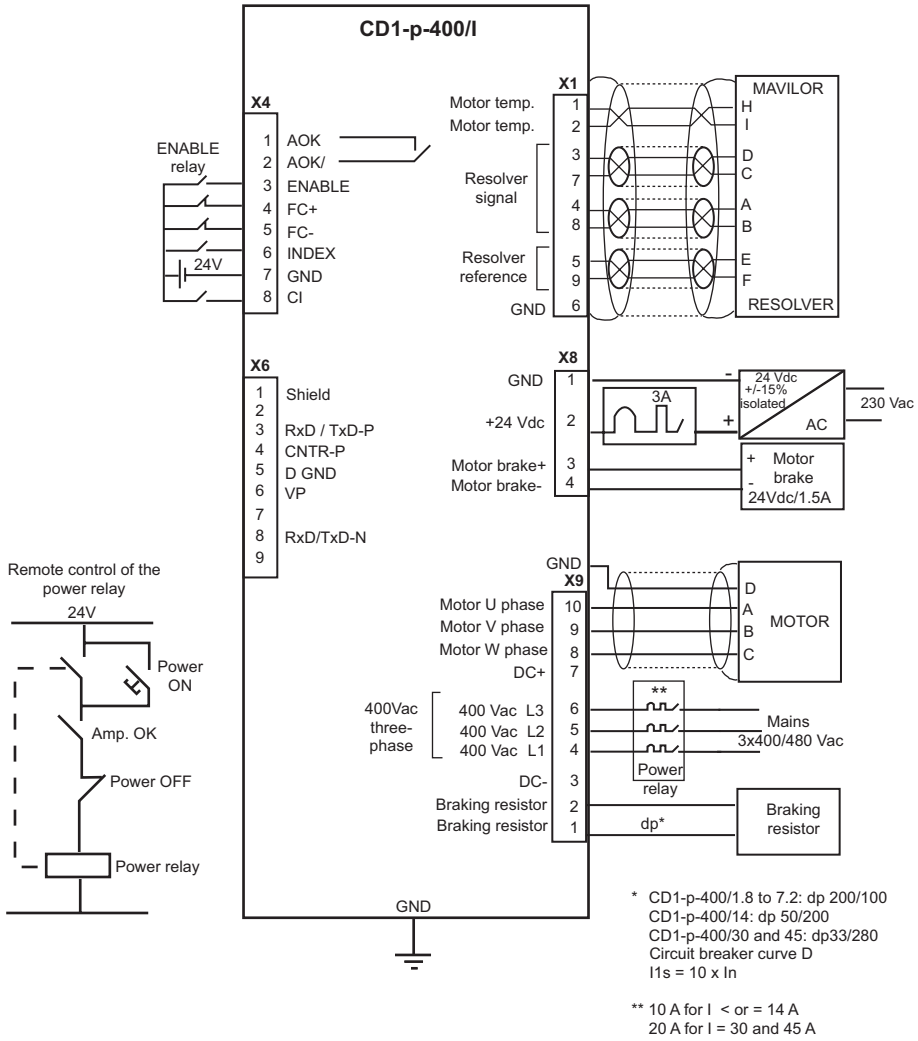
(For the UL compliant connection, see chapter 4, section 3.4).



Note: The 24 V and power supplies protection, on source side, must be made by the user.

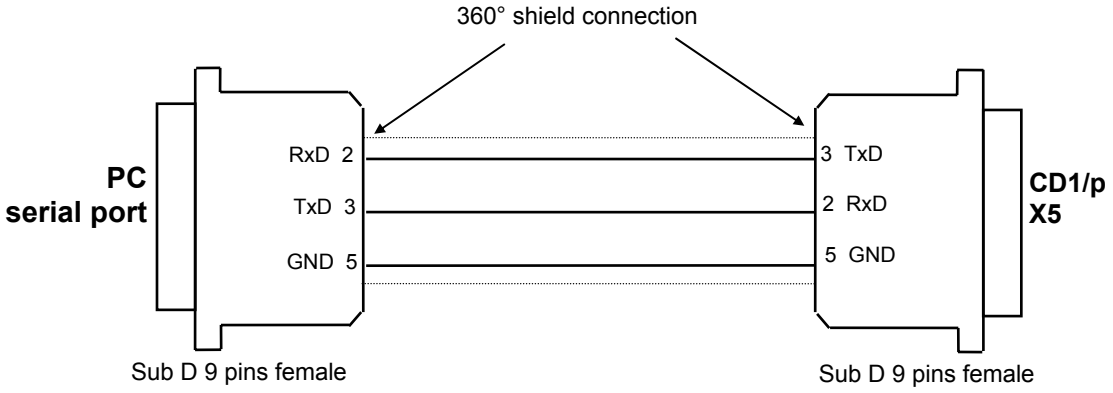
1.2 - CD1-p-400/I POSITIONER

See chapter 4, section 3.5 for the UL compliant connection

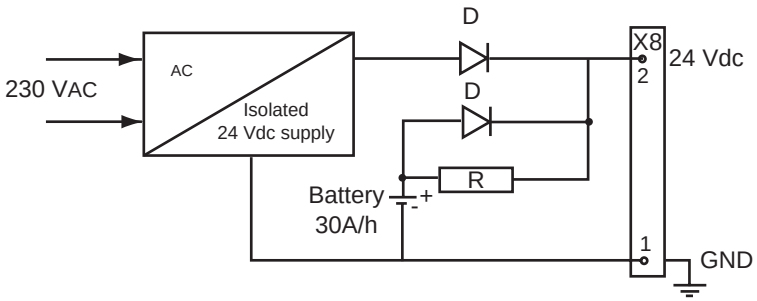


Note: The 24 V and power supplies protection, on source side, must be made by the user.

1.3 – SERIAL LINK CONNECTION

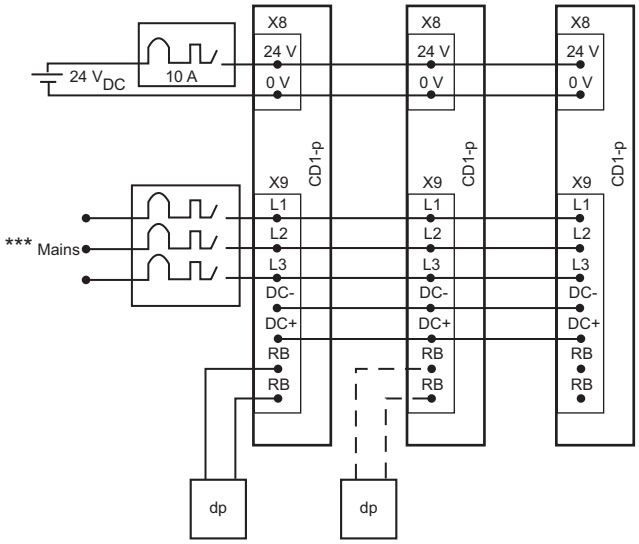


1.4 – CONNECTION OF A BACKUP BATTERY FOR THE 24 VDC AUXILIARY SUPPLY



The CD1-p positioner consumption is 320 mA with 24VDC. So, a 24 V / 30 A/h battery can keep the positioner under voltage during i.e. a long 3 days week-end or during a mains cut-off without loosing the machine initialization. This backup method is very interesting for saving the machine initialization as well as the axis position even when moving with mains switched off. An ASCII command allows to send the axis position to the digital host system.

1.5 – CONNECTION EXAMPLE FOR A MULTIAXIS APPLICATION



*** CD1-p-230/I : 3 x 230 V
CD1-p-400/I : 3 x 400 V
Circuit breaker curve D
I1s = 10 x In

For a multiaxis application with n drives, the circuit breaker current rating is given by the formula:

$In = 0{,}3 \sum_{1}^{n} I$ amplifier current rating

But, the current rating of the circuit breaker must not exceed:
- 20 A on 230 V drives,
- 20 A on 400 V / 1.8 to 14 A drives,
- 40 A on 400 V / 30 A and 45 A drives.

2 - WIRING RECOMMENDATIONS

(according to EN61000.4-2-3-4-5 and EN55011 standards - see diagram "Shield connection on the connectors " – chapter 4, section 2.2).

2.1 – EARTH WIRING AND EARTHING

CAUTION
Each potential conducting element must be **shielded**. Several potential conductors **in the same sleeve** must be **twisted and shielded**.

A shield has no effect if it is not connected:
- to a reference potential,
- by a connection as short as possible (a few centimeters; 10 centimeters is prohibited),
- by a "360°" shield connection. This means that the whole circumference of the shield sleeve must be connected to the reference conduction via a metal collar.

The connectors used for the compliance with the EN61000.4 standard must be made of metal or metallized and must allow the 360° shield connections.
Reference potential connections (especially with the ground) are recommended **only** these connections have a very low impedance (< 0,1 Ω). Any shield that is used as a conductor can be connected at both ends with the condition to be connected over 360° at both ends by means of metal links in order to ensure the shield continuity.

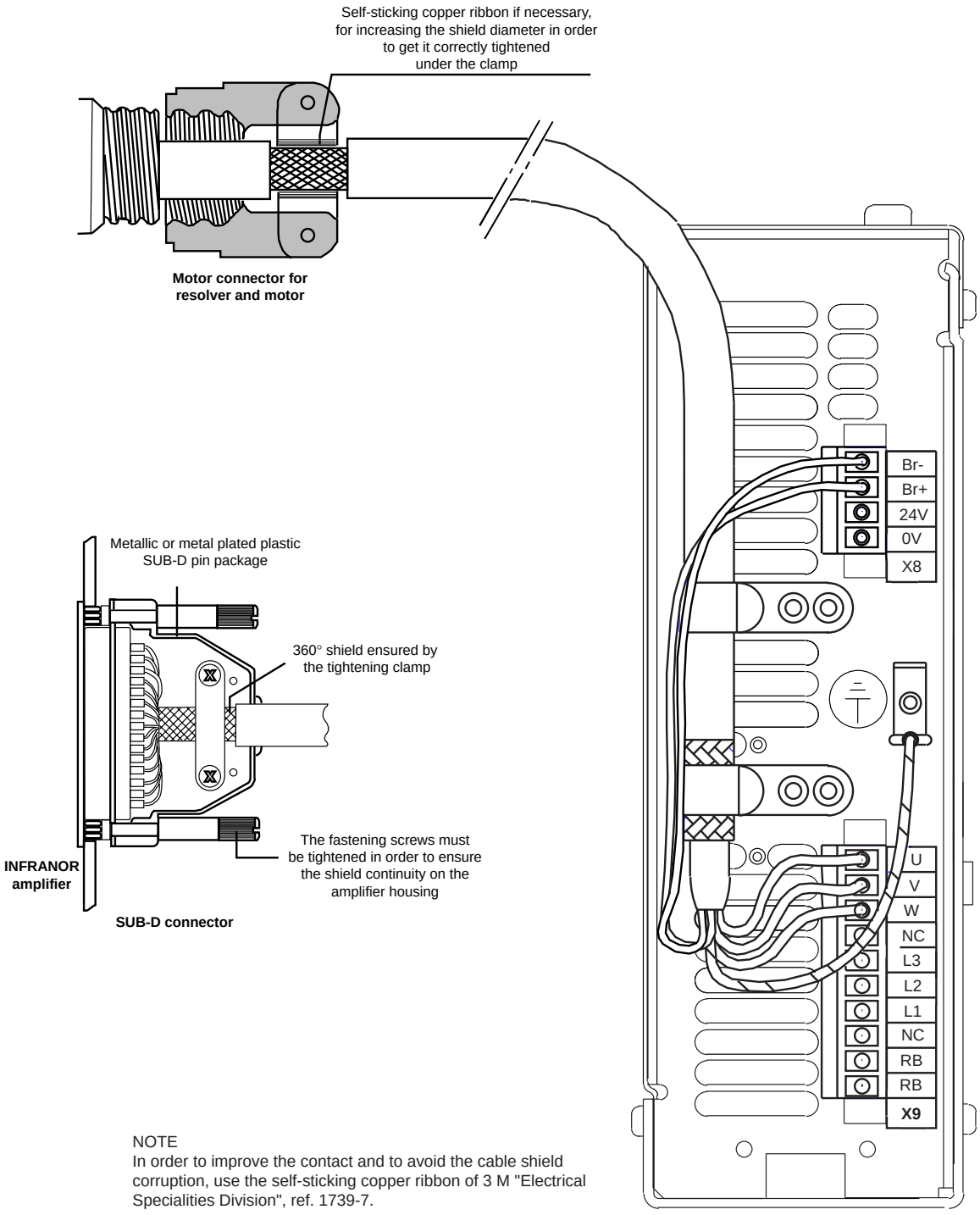
The reference potential must be the earth.

Cables with low potential should **never** run in the proximity of power lines.

If there is a potential reference, i.e. a main chassis or cabinet with a low impedance between its different elements, it should be used to connect ALL reference to it and also being grounded itself.

2.2 – CONNECTORS SHIELD CONNECTION

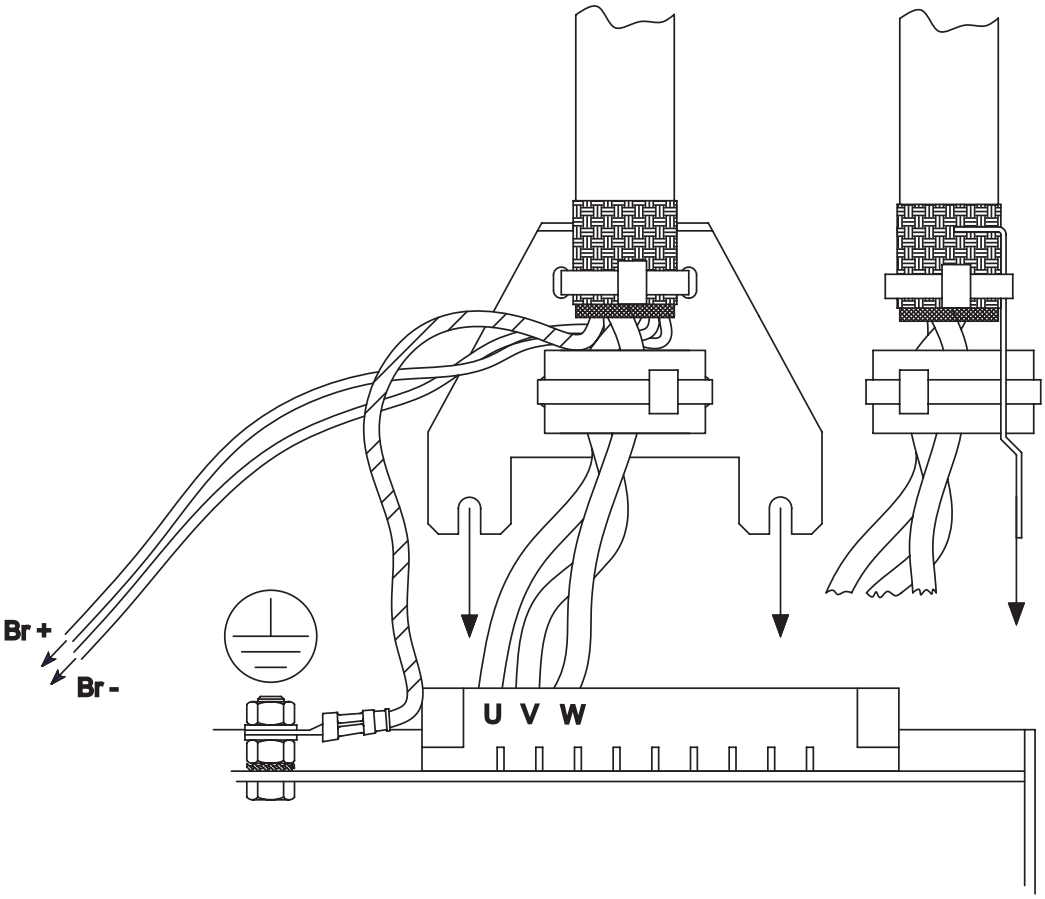
RULE
The shield should never be interrupted or corrupted over the whole cable length.



NOTE
In order to improve the contact and to avoid the cable shield corruption, use the self-sticking copper ribbon of 3 M "Electrical Specialities Division", ref. 1739-7.

NOTE
When the 360° shield connection is made by means of a collar, it is not necessary to connect a cable on the appropriate pin of the SUB-D connector.

2.3 – CONNECTION VUE OF CD1-p-400/30 and 400/45



2.4 - MOTOR AND RESOLVER CABLES

Motors and resolvers are grounded via their housing.

Cable inputs must be made by means of metal connectors with collars allowing the 360° shield connection.

The resolver cable must be pair twisted and shielded (sin, cos, ref.). Motor cables MUST also be shielded and connected over 360° at both ends as shown on shield connection diagram.
The cables of brake equipped motors must also have their brake cables shielded in order to be EMC compliant.

Maximum cable length:
- resolver: ≤ 100 m
- motor: 25 m ≤ d ≤ 100 m.

We advise:
- to use the maximum cable section allowed by the connectors,
- to mount a reactance with an inductive value between 1% and 3% of the motor inductive value. The reactance inductive value must be taken into account in the calculation of the current loops. The current rating of the reactance must be equal to or higher than the drive rating.

The reactance must be mounted at the drive output.
Due to the use of a reactance, a shielded cable is not mandatory anymore.
A more complex sinus filter type FN510 by Schaffner may also be mounted instead of the reactance.

Undesirable effects of motor cables longer than 25 m:
- Heating of the power module, the motor and the cable.
- High overvoltages on the motor windings involving a shortening of their life time.

The reactance reduces the undesirable effects on motor and drive but it may be quite heated. This requires an appropriate cooling.

2.5 - SERIAL LINK CABLES

The serial link cable must also be shielded according to the above mentioned shield connection recommendations.

CAUTION
Command cables (resolver, serial link, Profibus) as well as the power cables must be connected and disconnected with the positioner OFF.

Recall: The power voltage can remain several minutes on the capacitors terminals. A contact under high voltage may involve severe physical damage.

2.6 – CONNECTION CABLES OF THE BRAKING RESISTOR

The connection cable to the braking resistor housing must bear the high voltage and temperature (600 V/105° C).
Recommended cable: UL 1015 gauge 14.
Fastening torque on the connector of the braking resistor housing: dp = 0.9 Nm.

3 - REQUIREMENTS OF COMPLIANCE WITH THE UL STANDARDS

The UL listing requires the following conditions to be fulfilled by the installer of the drives.

3.1 – CONNECTION BY MEANS OF FASTON SOCKET

The installer must use a UL listed quick connect for ground connections (0.250 inches or 6.35 mm wide nominal) on all drives equipped with FASTON sockets.
On drives equipped with a screwed ground connector, the connection must be made via UL listed.

3.2 – 24 V SUPPLY

The end user has to provide a 24 VDC isolated power supply (e.g. with isolated transformer) for the auxiliary supply input, protected by a 4 A UL listed fuse.

3.3 – POWER SUPPLY AND UL FUSE RATING

The fuse type recommended for motor applications is of class RK5. The maximum short-circuit power of the mains must not exceed 5000 Arms at a voltage of 480 V, when protected by a UL fuse of type RK5.

On CD1-p-400/I drives, the fuse ratings must be the following:

CD1-p	400/1.8 to 7.2	400/14	400/30 and 45	Multiaxis
BUSSMANN Class RK5 Type FRS-R	FRS-R-4	FRS-R-8	FRS-R-20	$0{,}3 \times \sum_{1}^{N} I_{\text{rated amplifier}}$
LITTELFUSE Class RK5 Type FLSR-ID	FLSR2ID	FLSR8ID	FLSR20ID	$0{,}3 \times \sum_{1}^{N} I_{\text{rated amplifier}}$

For a multiaxis application with N drives, the fuse rating is calculated by the formula given in the table above. But a rating of 20 A must not be exceeded on 400/1.8 A to 14 A drives and 40 A must not be exceeded on 400/30 A and 45 A drives (see chapter 4, section 3.6).

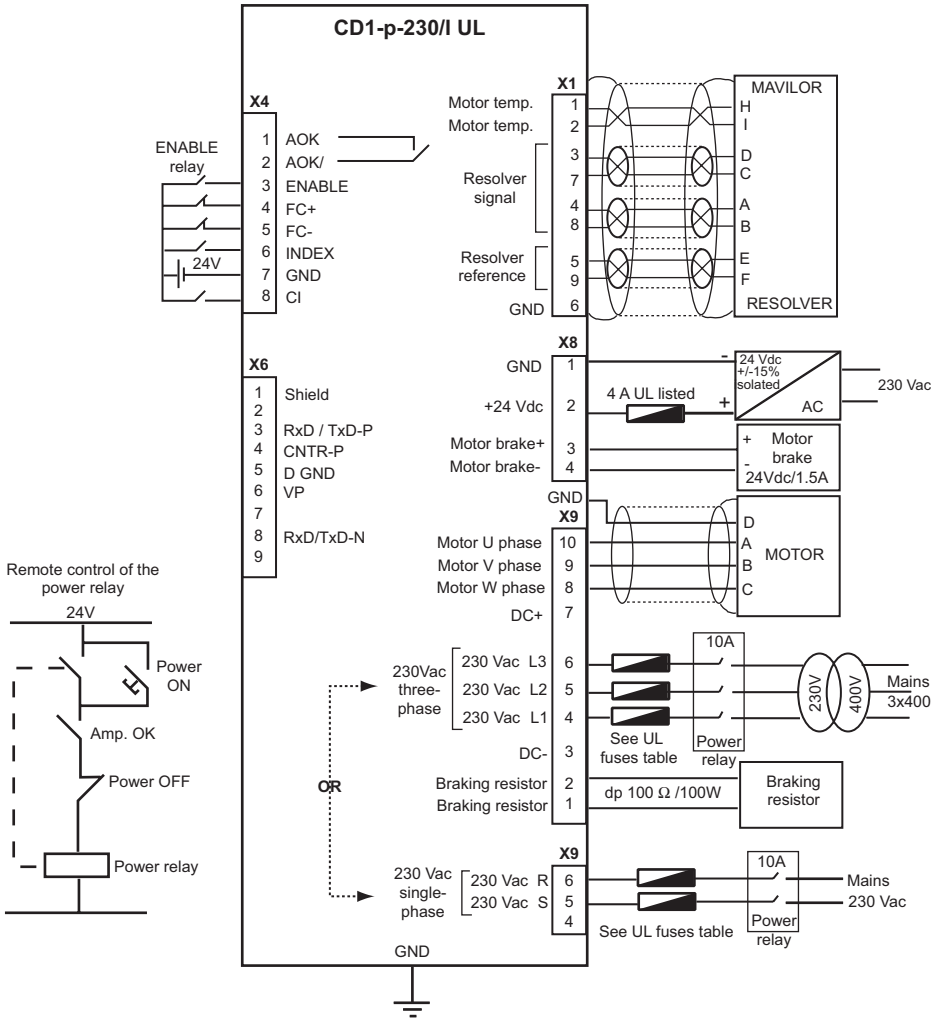
On CD1-p-230/I drives, the fuse ratings must be the following:

CD1-p	230/2.5 to 10.5	230/16.5	Multiaxis
BUSSMANN Class RK5 Type FRN-R	FRN-R-6	FRN-R-9	$0{,}3 \times \sum_{1}^{N} I_{\text{rated amplifier}}$
LITTELFUSE Class RK5 Type FLNR-ID	FLNR6ID	FLNR9ID	$0{,}3 \times \sum_{1}^{N} I_{\text{rated amplifier}}$

For a multiaxis application with N drives, the fuse rating is calculated by the formula given in the table above. But a rating of 20 A must not be exceeded on 230 V drives (see chapter 4, section 1.5).

3.4 – CD1-p-230/I DRIVE: CONNECTION DIAGRAM WITH PROTECTIONS BY "UL" FUSES

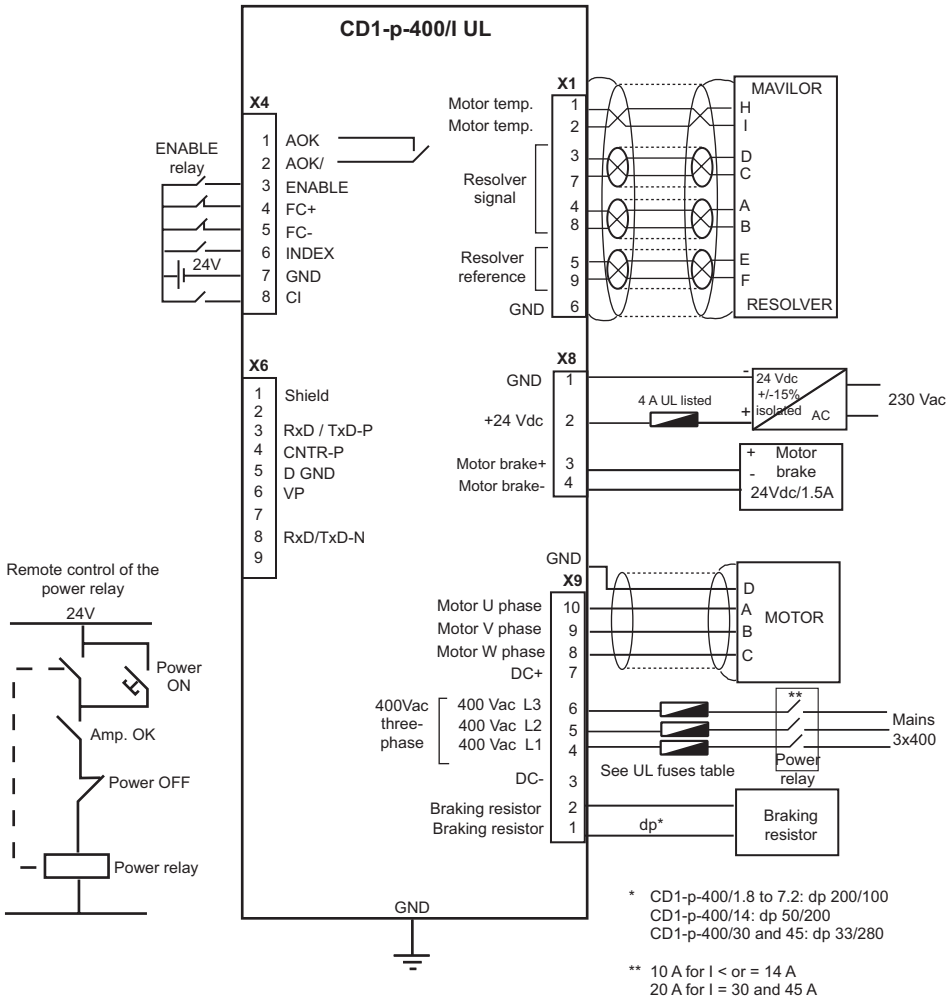
(according to section 3.3 of this chapter).



IMPORTANT

The installer of the drives has to use a UL listed quick connect for ground connection (0.250 inches or 6.35 mm wide nominal).
Field wiring terminals must use copper conductors only.
Torque value for field wiring terminals: according to the Recognized terminal block used.

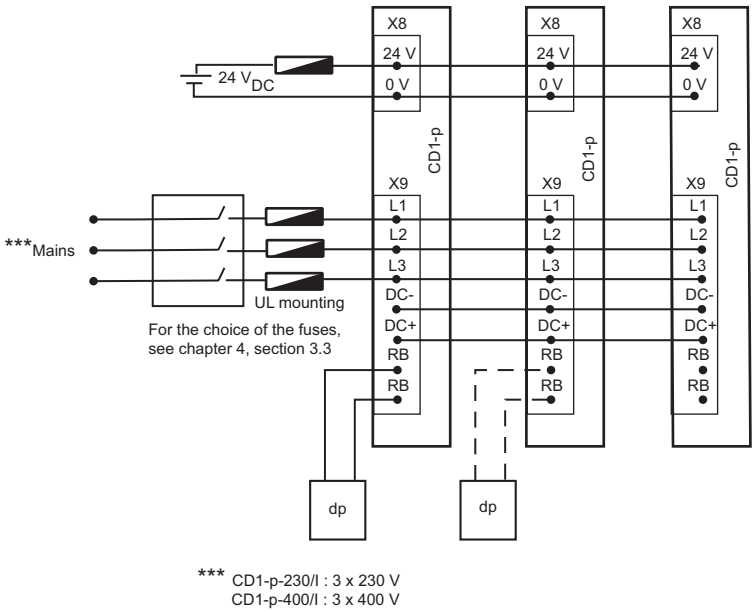
3.5 – CD1-p-400/I DRIVE: CONNECTION DIAGRAM WITH PROTECTIONS BY "UL" FUSES
(according to section 3.3 of this chapter)



IMPORTANT

- **The installer of the drives has to use a UL listed quick connect for ground connection (0.250 inches or 6.35 mm wide nominal)**
- **Field wiring terminals must use copper conductors only**
- **Torque value for field wiring terminals: according to the Recognized terminal block used.**

3.6 – CONNECTION EXAMPLE FOR A UL COMPLIANT MULTIAXIS APPLICATION



4 – FIRST POWERING OF THE CD1-p POSITIONER

4.1 - VERY IMPORTANT

Check the connections, particularly of the 24 VDC and power supplies. There are two different positioner voltage versions: 230 VAC and 400 VAC. Check for the appropriate label. It must be in accordance with the power connections. **The 400 VAC connection of a 230 V positioner will destroy it.**
The ENABLE signal (X4 connector, pin 3) must be inactive.

Check for the braking resistor sizing:
- dp 100/100 for 230 VAC
- dp 200/100 for 400 VAC and current ratings 1.8 to 7.2.
- dp 50/200 for 14 A current rating.
- dp 33/280 for 30 and 45 A current ratings

Any braking resistor value lower than 200 Ω for the CD1-a-400/1.8 to 7.2 A amplifier will definitely damage the braking system.
Check for the correct earthings and 360° shield connections.

WARNING
During the machine adjustments, some drive connection or parameter setting errors may involve dangerous axis movements. It is the user's responsibility to take all necessary steps in order to reduce the risk due to uncontrolled axis movements during the operators' presence in the concerned area.

4.2 - SWITCH ON THE 24 VDC SUPPLY

The green front panel "ON" Led must light up.
The red front panel "AP" Led must light up.
The "AOK" relay contact (pins 1 and 2 of X4) is closed. It is possible to control the power relay according to the recommendations of Chapter 4, section 1: Connection diagrams).

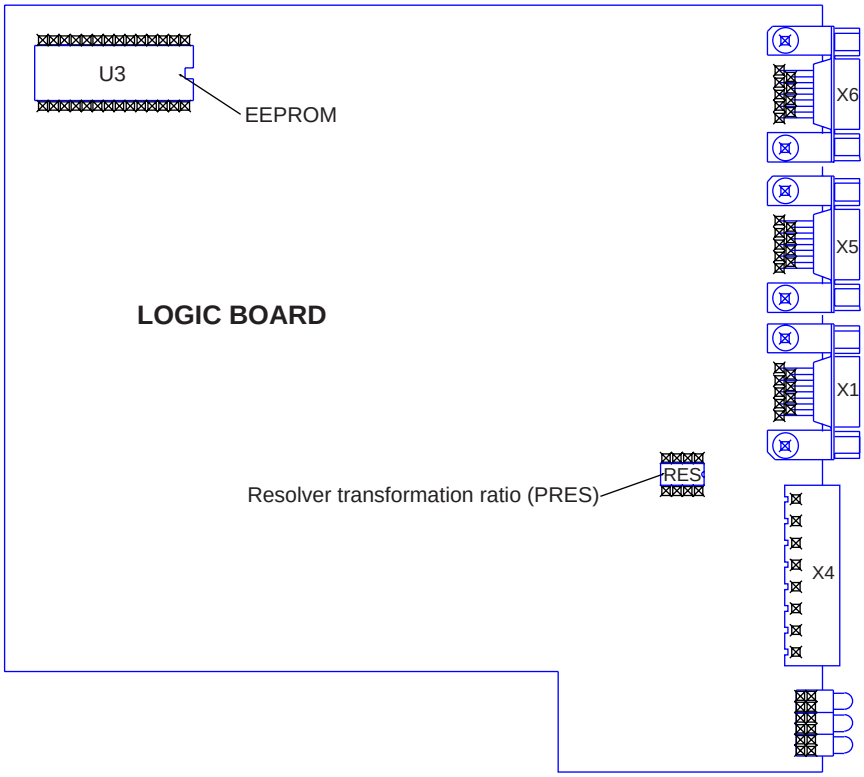
4.3 – SWITCH ON THE 230 VAC OR 400 VAC SUPPLY (according to the positioner type).

4.4 – FURTHER COMMISSIONING PROCEDURE

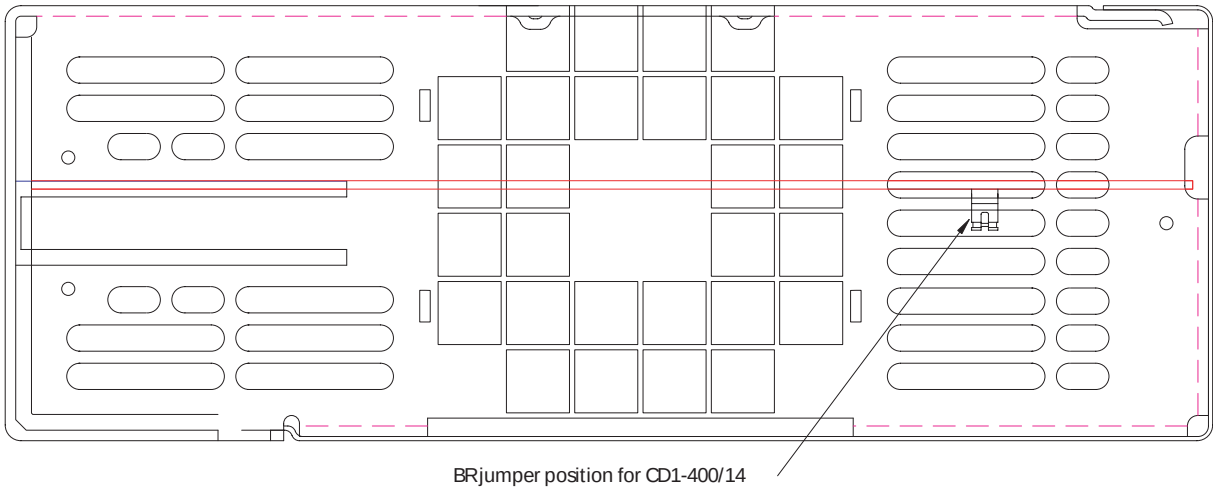
See manual "*SMT-BD1/p CD1-p User guide*".

Chapter 5 – Appendix

1 – HARDWARE ADJUSTMENTS

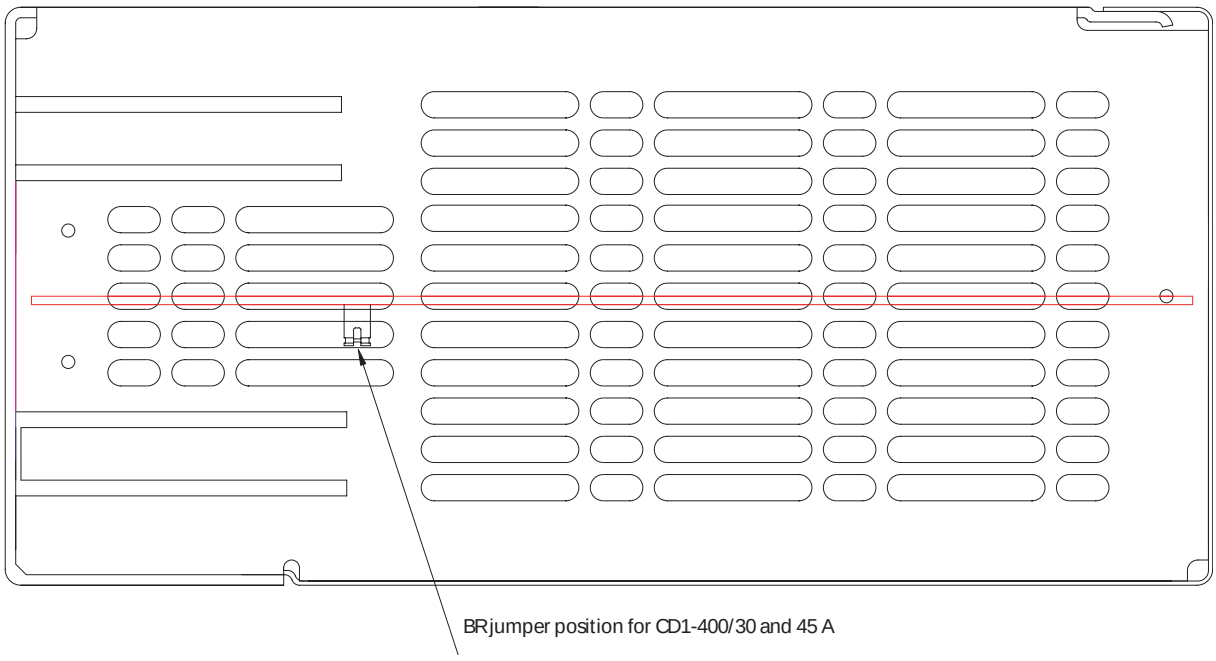


2 – BR JUMPER POSITION FOR CD1-p-400/14 A



Position of the BR jumper (to be removed through the hood louver without opening the amplifier, if the MOTOR BRAKE output is not used).

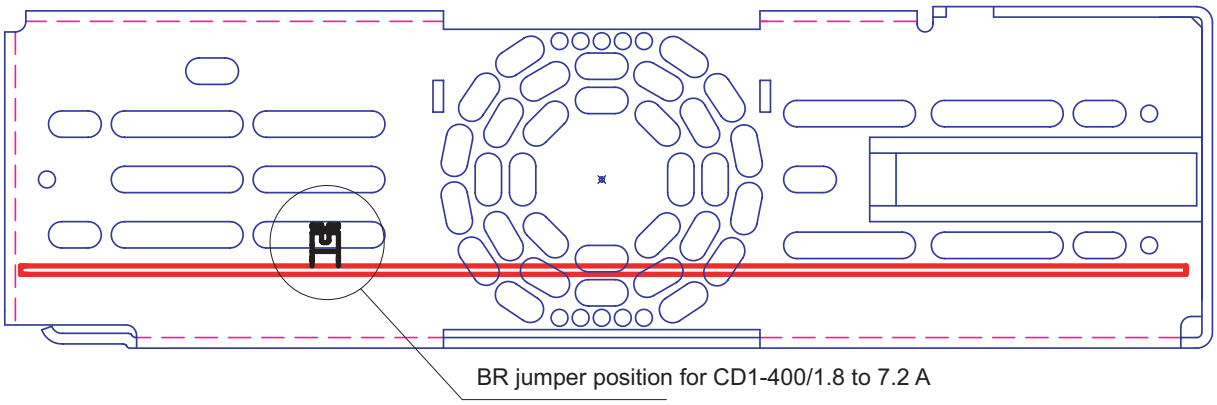
3 – BR JUMPER POSITION FOR CD1-p-400/30 AND 400/45 A



Position of the BR jumper (to be removed through the hood louver without opening the amplifier, if the MOTOR BRAKE output is not used).

4 – BR JUMPER POSITION FOR CD1-400/1.8 TO 7.2 A

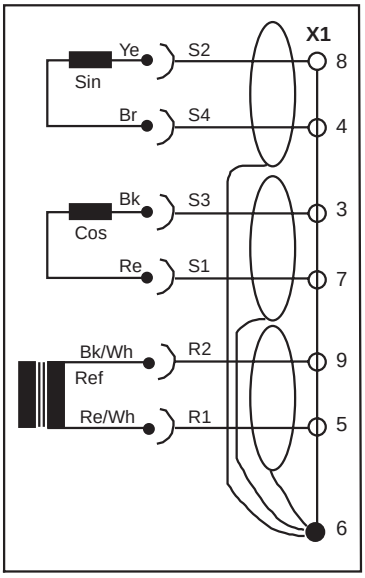
This jumper is available on drives which traceability index mentioned on the ID sticker is:
"P" or higher for CD1-p-400/I drives and
"D" or higher for CD1-pm-400/I drives.



Position of the BR jumper (to be removed through the hood louver without opening the amplifier, if the MOTOR BRAKE output is not used).

5 – ADJUSTMENT TO VARIOUS RESOLVER TYPES

For the use of **resolvers** other than those mounted on MAVILOR motors, see following wiring diagram of the **X1** connector as well as the manufacturer's diagram:



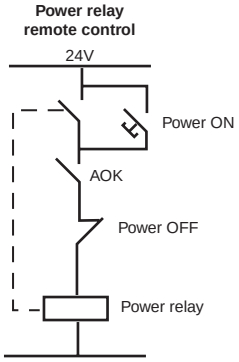
For the use of **resolvers** with **transformation ratios** others than 0.5, the Cos and Sin signal amplitude must be adjusted by means of the "**P-RES**" components according to the table below:

	P-RES			
Transformation ratio	0.3	0.45	0.5	1
A - B - C - D tolerance < 1 %	21 K	14.3 K	12.7 K	6.34 K

NOTE
When using resolvers with a number of pole pairs N > 1, all speed values displayed in the positioner are equal to N times the motor rotation speed.

6 - USE OF THE "AOK" OUTPUT

The "AOK" output MUST be used on a potential free relay in order to allow the connection of the power supply (see Chapter 4, section 1: Connection diagrams).
The correct positioner operation requires this connection logic. Switching on the power supply before initializing the 24 VDC auxiliary supply will hinder the operation. It will then be necessary to proceed according to the recommendations of this manual.



7 – ENERGY RECUPERATION VIA A BRAKING RESISTOR

All CD1 drives are equipped with the power feedback system. When the motor is decelerating with high inertia and high speed, the mechanical braking energy is reflected to the drive. This energy is dissipated inside a resistor called "braking resistor".
In order to avoid heat dissipation inside the drive, the braking resistor is **ALWAYS** mounted outside. It **MUST** be mounted out of range of elements sensitive to heat and inflammable (plastic, cable sleeves, etc.).

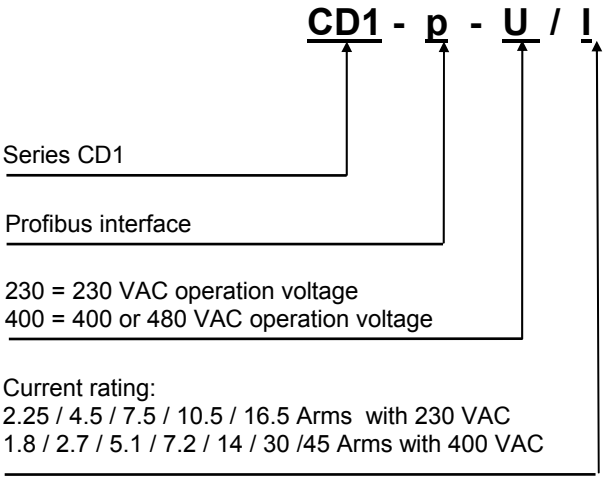
For an optimum energy recuperation by the drives in a multiaxis application, the DC bus (DC+ and DC-) can be connected in parallel (see diagram in chapter 4, section 1.5).
In this case, the mains input must also be parallel wired in order to balance the current load inside the AC/DC converters.

It is recommended to mount the braking resistor on the drive with highest current rating.
On 400 V drives:
CD1-p and CD1-pm 30 A and 45 A,
CD1-p-400/1.8 to 7.2 A with index "P" or higher,
CD1-p-400/14 A with index "I" or higher,
CD1-pm-400/1.8 to 7.2 A and CD1-pm-400/14 with index "D" or higher,
an electronic control of the reflected power avoids the overloading of the braking resistor. So, if the energy reflected to the drives with parallel mounted DC busses is too high, the DC bus voltage will rise up to the triggering of the "**Overvoltage**" fault. A second resistor must then be mounted on the second axis.

AVAILABILITY OF THIS FUNCTION ON 400 V DRIVES ACCORDING TO TABLE BELOW:

DRIVE TYPE	TRACEABILITY INDEX
CD1-p-400/1.8 A to 7.2 A	≥ P
CD1-p-400/14 A	≥ I
CD1-p-400/30 A and 45 A	≥ A
CD1-pm-400/1.8 A to 7.2 A	≥ D
CD1-pm-400/14 A	≥ D
CD1-pm-400/30 A and 45 A	≥ A

8 - ORDER CODE


CD1 - p - U / I
Series CD1
Profibus interface
230 = 230 VAC operation voltage
400 = 400 or 480 VAC operation voltage
Current rating:
2.25 / 4.5 / 7.5 / 10.5 / 16.5 Arms with 230 VAC
1.8 / 2.7 / 5.1 / 7.2 / 14 / 30 /45 Arms with 400 VAC